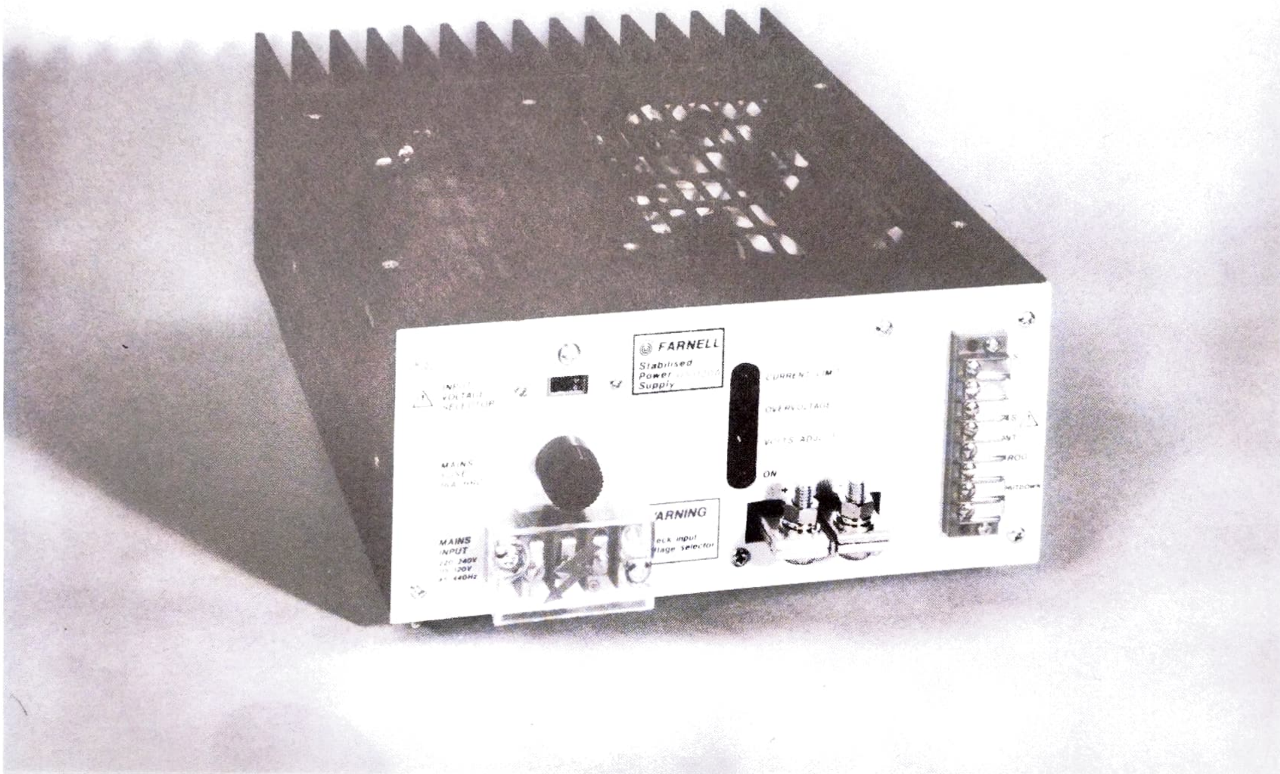
Provisional data

Farnell

600 watt G range switched-mode power supplies



Switched-mode technique for compactness and high efficiency

220–240 or 115–120V, 45–440Hz input. Selected by front panel selector switch. Also accepts 310–340V d.c. input

Generous 'brown-out' tolerance –20% to +10% of nominal input

Two models available: 5V, 120A (or up to 6V, 100A) 48V, 12.5A

LEDs indicate output on, current limiting and overvoltage protection

Soft start limits switch on surge current

Compatible with other manufacturers' fixing

Tailored versions and specials made to order

The Farnell 600 watt G range power supplies use a switching technique to provide stabilised d.c. from a.c. or d.c. inputs. This permits production of compact, lightweight and highly efficient units with an output power density of around two watts per cubic inch with a panel height of only 88mm. The units will operate from all normal international mains supplies and a front panel selector switch provides a choice of 220 to 240 volts or 115 to 120 volts with a tolerance of –20% to 10% of nominal. These particular units will also accept a d.c. input of between 310 to 340 volts provided they are set to the 230 volt tap. Once the required input is set a cover over the switch prevents accidental selection of the wrong input.

Two models are available in the same mechanical package and give a maximum output power of 600 watts The G5–120A, which normally is set to provide 5 volts at 120 amps, can be adjusted via a front panel potentiometer to give 6 volts at 100 amps. The G48–12.5A gives 48 volts at 12.5 amps but can be adjusted to provide an output between 32 and 50.4 volts without derating current. Output presence, and the state of the current limit and overvoltage protection modes are indicated by front panel LEDs. Output voltage may be programmed by an external resistor or remotely inhibited. Provision is made for remote sensing of the voltage at the load to compensate for voltage drop across the load connecting leads. A soft start circuit is used to limit the peak value of input current at switch on and both units are designed to meet international specifications for conducted radio frequency interference.

The Farnell G range includes single output units rated at 30, 60, 120, 240, 360 and 600 watts. Triple output units are also available. Further information, including MTBF figures, are available – please ask. A range of multi-output open frame switchers was also introduced in 1980.

Specification

Mains input 220 to 240V or 115 to 120V set by front panel selector switch. 45 to 440Hz. Also operates from 310-340V d.c. when set in 230V position.

Mains variation tolerated 220V −20% to 240V +10% a.c. 115V −20% to 120V +10% a.c. 310V −20% to 340V +10% d.c.

Output

Nominal output voltage	Max. output current	Voltage range adjust.	Model No.
5V d.c.	120A	4–6V	G5–120A
48V d.c.	12.5A	32–50.4V	G48–12.5A

Note: G5–120A should be derated to 100A from 5.25V to 6V

Output voltage regulation 0.1% maximum variation from a worst case combination of 0 to 100% load change and 220V−10% to 240V +10% or 115V−10% to 120V +10% line change

Ripple and noise At full load (30MHz bandwidth). Less than 20mV r.m.s., 75mV p−p

Temperature coefficient +0.01% per °C typical

Output impedance 100mΩ typical at 100kHz and 25°C

Transient recovery time Typically 2ms for output to recover within 50mV following a 10% to 100% or 100% to 10% load change of 5µs risetime. Typical instantaneous output deviation 600mV

Hold up time Output will be maintained for the duration of a missing mains cycle (28ms) at maximum output current and −10% of nominal mains input when the output is at 5.25V max., 120A or 6V, 100A or nominal +5%

Switch-on surge Limited by soft start circuit. Max. peak current 64A. Typically 45A

Switch-on time Output established with 400ms

Maximum operating ambient temperature 70°C max. Output current should derate linearly from full load at 55°C to half load at 70°C

Operating ambient temperature range −10°C to +55°C for full load output current. Convection cooled free air rating

Storage temperature range −40°C to +85°C

External programming Output voltage may be programmed from 1V upwards with an externally connected resistor. Programming resistance 1000Ω per volt ±0.5%

Remote sensing Up to 5V max. drop in each output lead permitted. However, unit output terminal voltage must not exceed 6V for G5–120A or nominal +5% for other units

Remote switch-off Output may be shutdown by a 5V logic 'high' t.t.l. compatible signal applied to + and − shutdown terminals. Drive current 20mA typical. Input isolated from unit output and tested at 1kV a.c. r.m.s.

Series and parallel operation Any number of units with the same output voltage may be connected in parallel. Outputs of similar current rating may be connected in series up to a maximum total output voltage of 250V

Insulation Tested at 2.5kV a.c. for one minute between a.c. input and d.c. output applied as 1.5kV a.c. input to earth and 1kV a.c. output to earth simultaneously.

Efficiency Better than 70%. Typically 77% at full load

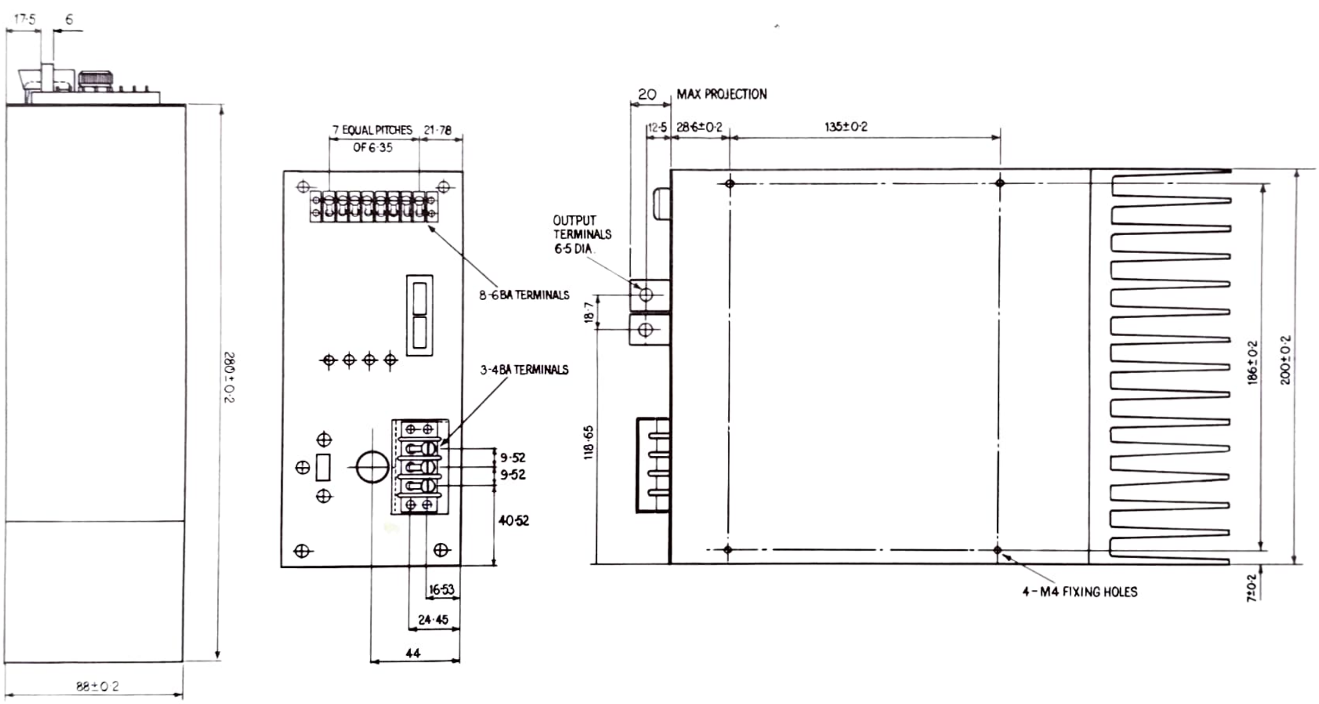
Protection **Overload:** Constant current limiting set at 110% ±5% of full load current. A front panel LED illuminates when current is limiting. Self resetting.
Option C: As above but after 200ms of overload the output is disabled.
Overvoltage: Set at nominal output voltage +20%. Disables control circuit and output falls to zero. Reset by interrupting the mains input supply. A front panel LED illuminates when the control circuit has been disabled.
Fuse: The a.c. input is fused

Radio frequency interference Units comply with the conducted interference requirements of VDO875 curve N, CISPR (publication 11) curve N and BS800

Dimensions (excluding terminals) Height 88mm Width 200mm Depth 280mm

Weight 6.4kg

Mechanical details



Represented overseas by:

Manufactured in England by:

FARNELL INSTRUMENTS LIMITED
SANDBECK WAY · WETHERBY
WEST YORKSHIRE LS22 4DH
TELEPHONE (0937) 61961
TELEX 557294 FARIST G

REGIONAL OFFICE (SOUTH)
TELEPHONE: HARPENDEN (05827) 69071
TELEX: 826307 FARINT G

Printed in England. 8·80

INSTRUCTION BOOK FOR

600 WATT G RANGE

POWER SUPPLIES

FARNELL IN[illegible]MENTS LIMITED, WETHERBY, WEST YORKSHIRE LS22 4DH TEL. 0937 61961

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Specification 3

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SCHEDULE OF EQUIPMENT

The unit has been carefully packed to prevent damage in transit. When removing the box ensure that all parts and accessories are removed from the packing material.

The complete equipment comprises:-

a) 1 off G range power supply of the type specified on order

b) 1 off instruction book

c) 1 off packet of accessories comprising:-

1 off spare fuse

2 off output terminal nuts

4 off washers flat

4 off washers spring

9 off terminal tags

4 off fixing screws 8mm long (see note in paragraph 'Mounting and ventilation' on page 8)

Note:- In the event of damage in transit or shortage in delivery, separate notices in writing should be given to both the carriers and Farnell Instruments Ltd., within three days of receipt of the goods, followed by a complete claim within five days. All goods which are the subject of any claim for damage in transit or shortage in delivery should be preserved intact as delivered, for a period of seven days after making the claim, pending inspection or instructions from Farnell Instruments Ltd., or an agent of this Company.

INTRODUCTION

The Farnell 600 watt G range power supplies use a switching technique to provide stabilised d.c. from a.c. or d.c. inputs. This permits the production of compact, lightweight and highly efficient units with an output power density of around two watts per cubic inch with a panel height of only 88mm. The units will operate from all normal international mains supplies and a front panel selector switch provides a choice of 220 to 240 volts or 115 to 120 volts with a tolerance of -20% to +10% of nominal. These particular units will also accept a d.c. input of between 310 to 340 volts provided they are set to the 230 volt tap. Once the required input is set a cover over the switch prevents accidental selection of the wrong input.

Two models are available in the same mechanical package and give a maximum output power of 600 watts. The G5-120A, which normally is set to provide 5 volts at 120 amps, can be adjusted via a front panel potentiometer to give 6 volts at 100 amps. The G48-12.5A gives 48 volts at 12.5 amps but can be adjusted to provide an output between 32 and 50.4 volts without derating of current. Output presence, and the state of the current limit and overvoltage protection modes are indicated by front panel l.e.ds. Output voltage may be programmed by an external resistor or remotely inhibited. Provision is made for remote sensing of the voltage at the load to compensate for voltage drop across the load connecting leads. A soft start circuit is used to limit the peak value of input current at switch on and both units are designed to meet international specifications for conducted radio frequency interference.

SPECIFICATION

MAINS INPUT	220 to 240V or 115 to 120V set by front panel selector switch. 45 to 440Hz. Also operates from 310-340V d.c. when set in 230V position.
MAINS VARIATION TOLERATED	220V -20% to 240V +10% a.c. 115V -20% to 120V +10% a.c. 310V -20% to 340V +10% d.c.

OUTPUT

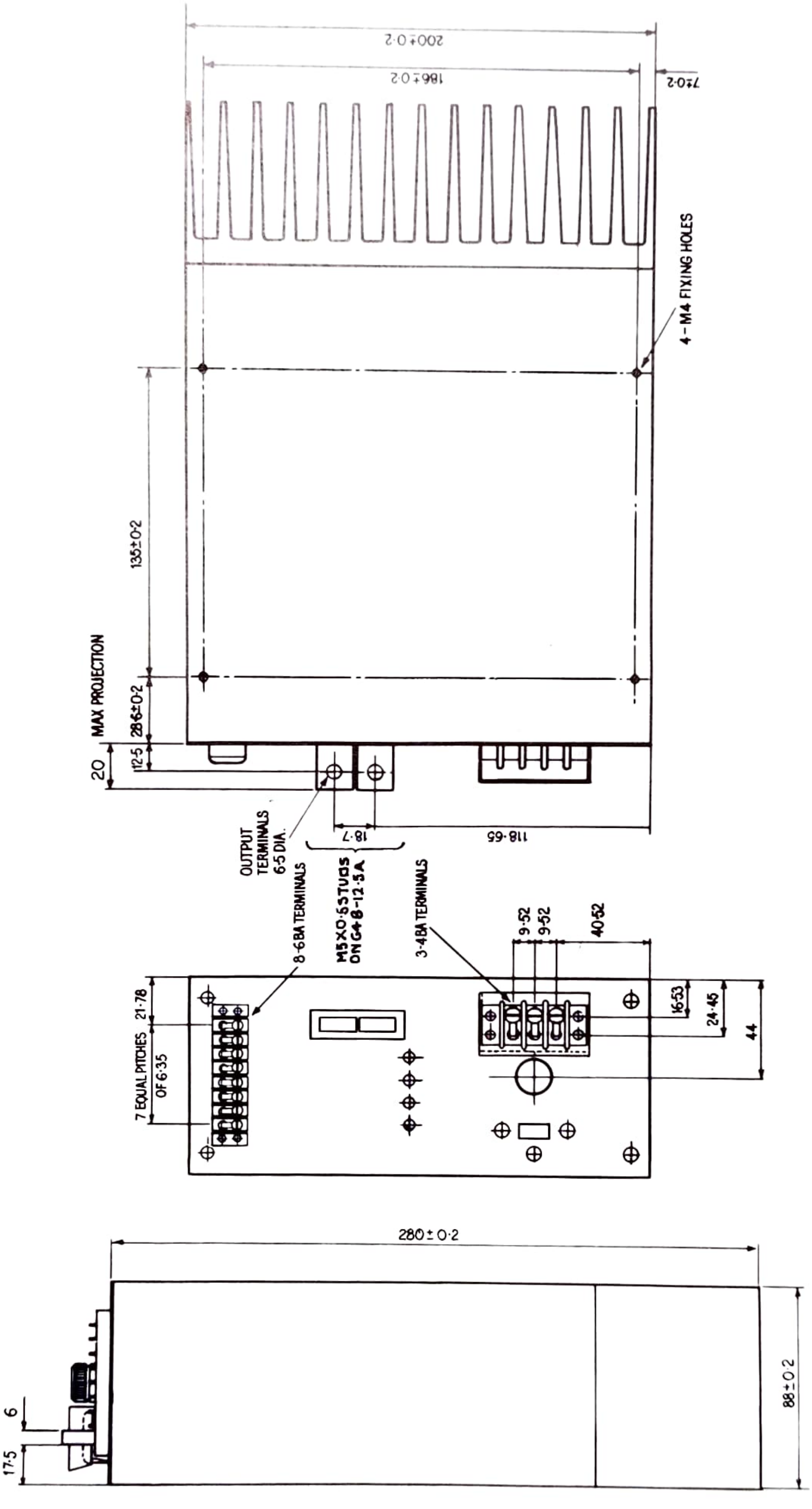
Nominal output voltage	Max. output current	Volts adjust range	Model No.
5V d.c.	120A	4-6V	G5-120A
48V d.c.	12.5A	32-50.4V	G48-12.5A

Note: G5-120A should be derated to 100A from 5.25V to 6V

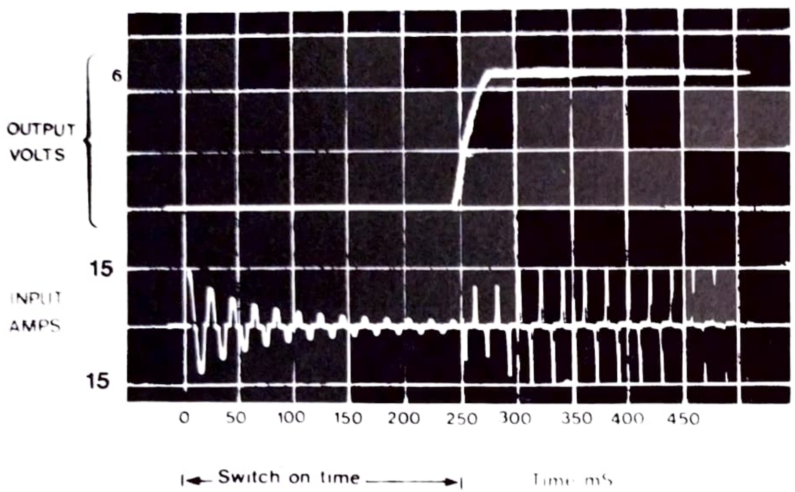
OUTPUT VOLTAGE REGULATION	0.1% maximum variation from a worst case combination of 0 to 100% load change and 220V -10% to 240V +10% or 115V -10% to 120V +10% line change
RIPPLE AND NOISE	At full load (30MHz bandwidth) Less than 20mV r.m.s., 50mV p-p
TEMPERATURE COEFFICIENT	±0.01% per °C typical
OUTPUT IMPEDANCE	100mΩ typical at 100kHz and 25°C
TRANSIENT RECOVERY TIME	Typically 2ms for output to recover within 50mV following a 10% to 100% or 100% to 10% load change of 5µs risetime. Typical instantaneous output deviation 600mV.
HOLD UP TIME	Output will be maintained for the duration of a missing mains cycle (28ms) at maximum output current and -10% of nominal mains input when the output is at 5.25V max., 120A or 6V, 100A or nominal +5%
SWITCH-ON SURGE	Limited by soft start circuit. Max. peak current64A. Typically 45A.
SWITCH-ON TIME	Output established within 400ms
MAXIMUM OPERATING AMBIENT TEMPERATURE	70°C max. Output current should derate linearly from full load at 55°C to half load at 70°C
OPERATING AMBIENT TEMPERATURE RANGE	-10°C to +55°C for full load output current. Convection cooled free air rating.
STORAGE TEMPERATURE RANGE	-40°C to +85°C
EXTERNAL PROGRAMMING	Output voltage may be programmed from 1V upwards with an externally connected resistor. Programming resistance 1000Ω per volt ±0.5%
REMOTE SENSING	Up to 5V max. drop in each output lead permitted. However, unit output terminal voltage must not exceed 6V for G5-120A or nominal +5% for other units.

REMOTE SWITCH-OFF	Output may be shutdown by a 5V logic 'high' t.t.l. compatible signal applied to + and - shutdown terminals. Drive current 20mA typical. Input isolated from unit output and tested at 1kV a.c. r.m.s.
SERIES AND PARALLEL OPERATION	Any number of units with the same output voltage may be connected in parallel. Outputs of similar current rating may be connected in series up to a maximum total output voltage of 250V.
INSULATION	Tested at 2.5kV a.c. for 1 minute between a.c. input and d.c. output applied as 1.5kV a.c. input to earth and 1kV a.c. output to earth simultaneously.
EFFICIENCY	Better than 70%. Typically 77% at full load
PROTECTION	*Overload:* Constant current limiting set at 110% ±5% of full load current. A front panel l.e.d illuminates when current is limiting. Self re-setting. *Option C:* As above but after 200ms of overload the output is disabled. *Overvoltage:* Set at nominal output voltage +20% Disables control circuit and output falls to zero. Reset by interrupting the mains input supply. A front panel l.e.d. illuminates when the control circuit has been disabled. *Fuse:* The a.c. input is fused
RADIO FREQUENCY INTERFERENCE	Units comply with the conducted interference requirements of VDE0875 curve N, CISPR (publication 11) curve N and BS800.
DIMENSIONS (excluding terminals)	Height 88mm Width 200mm Depth 280mm
WEIGHT	6.5kg

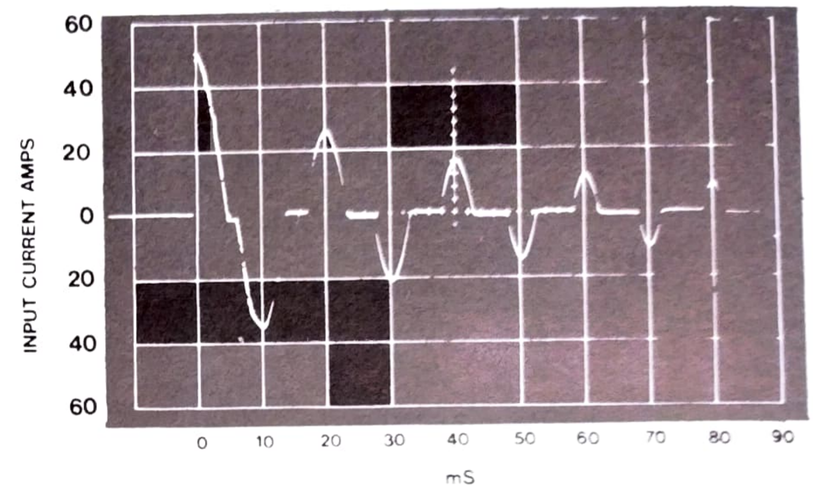
MECHANICAL DETAILS



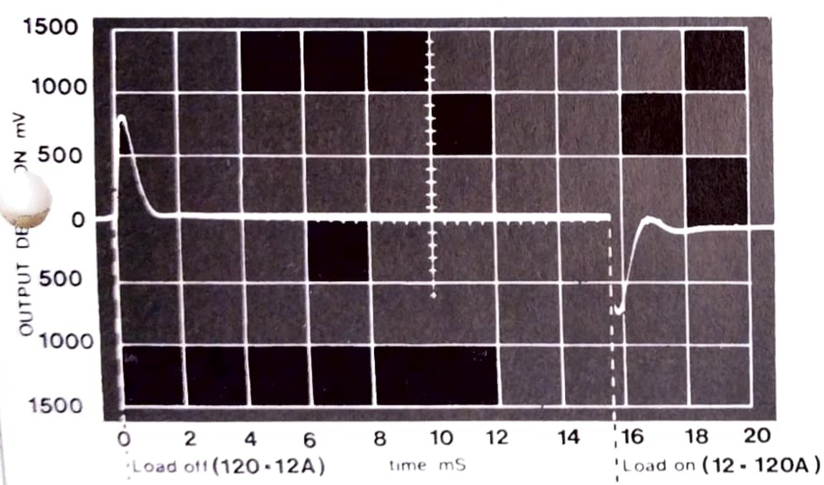
SWITCH ON TIME G5 · 120A (TYPICAL)
240V a.c. INPUT



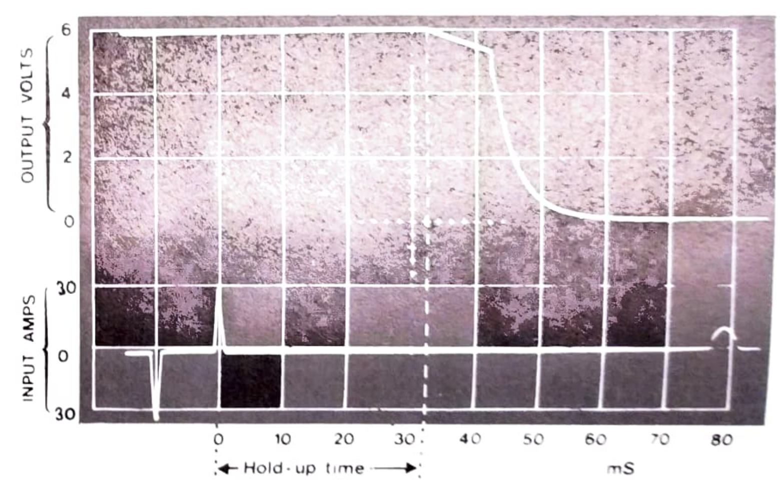
SWITCH ON SURGE G5 · 120A (TYPICAL)
264V a.c. INPUT

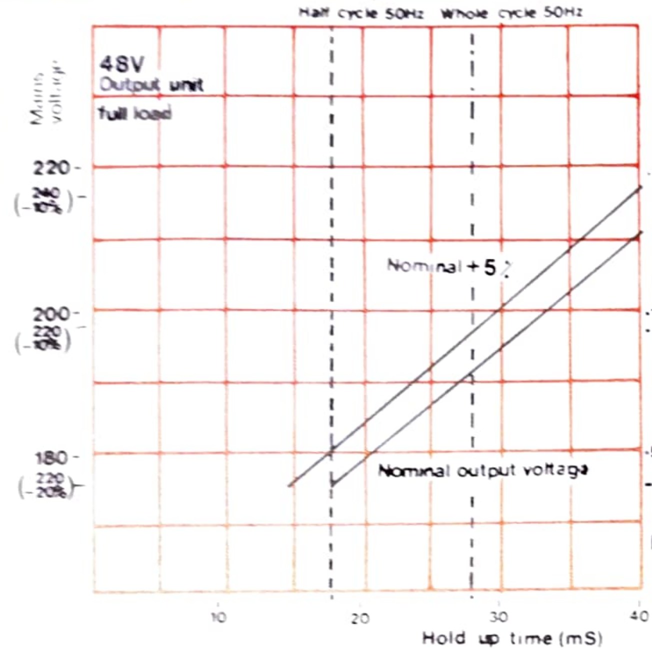


OUTPUT TRANSIENT RESPONSE
5uS RISE TIME G5·120A (TYPICAL)

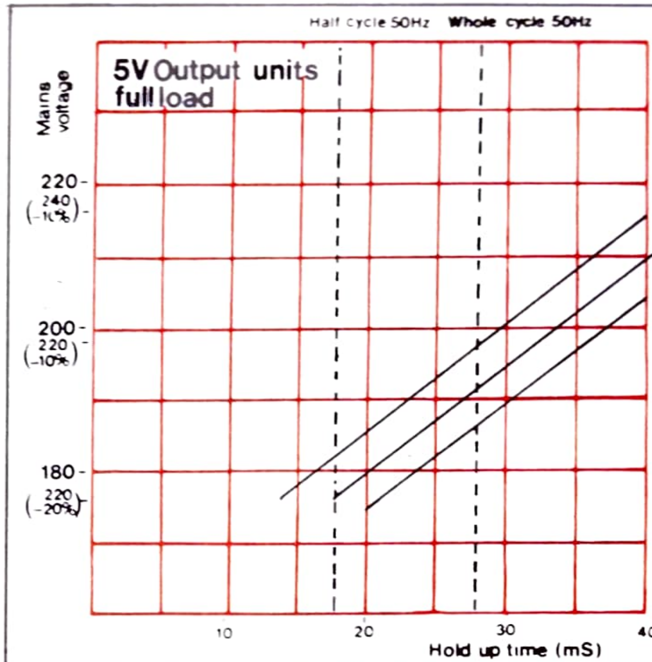


HOLD-UP TIME AFTER INPUT DISCONNECTION
103.5V a.c. INPUT 6V 100A O/P. G5·120 A (TYPICAL)



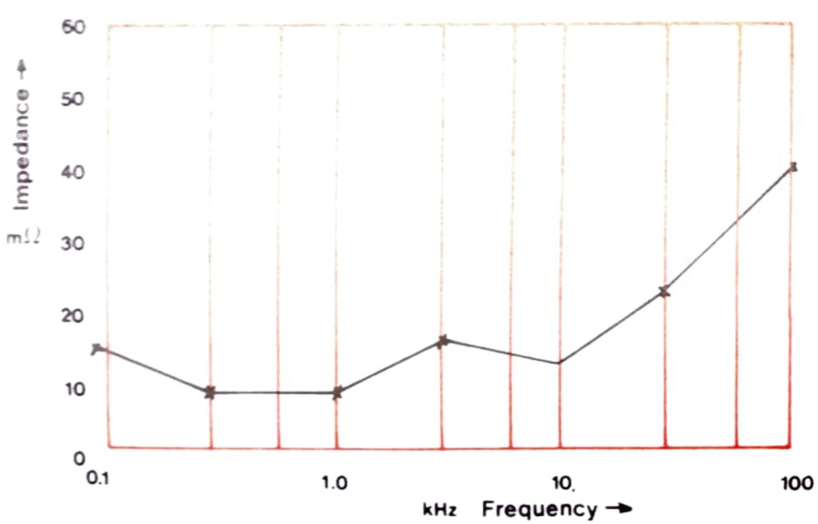


MINIMUM HOLD-UP TIME
48V UNIT



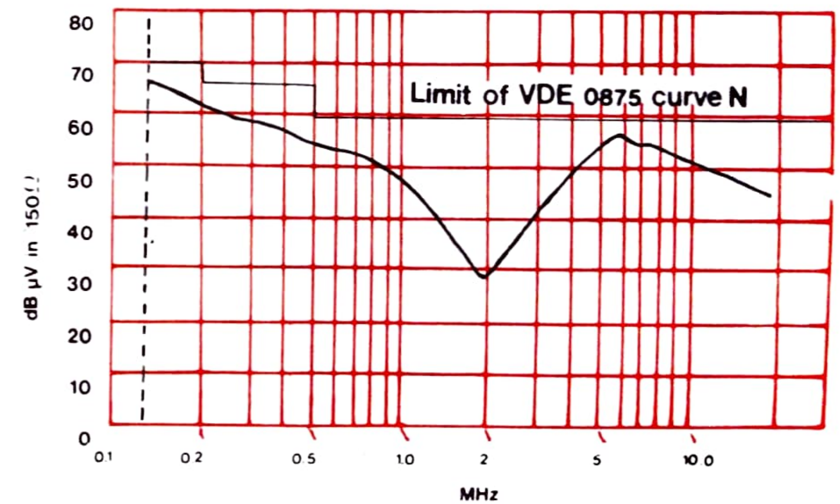
MINIMUM HOLD-UP TIME
G5·120A

Output impedance G5·120A (typical)



CONDUCTED R.F. VOLTAGE ON INPUT TERMINALS

Conducted and radiated interference were within VDE 0875 curve N limits on a sample **G5·120A** *independently assessed*



OPERATING INSTRUCTIONS

Warning!

Hazardous voltages exist at various points within the unit since several major areas of the circuitry are at mains potential. DO NOT REMOVE ANY COVER PLATE WITHOUT FIRST DISCONNECTING THE INPUT SUPPLY.

Mains input

The mains input terminals are located on the 3 way terminal block at the left hand side of the unit front panel and marked L (live), N (neutral) and ⏚ (earth). The unit will operate from either a 115-120V supply or a 220-240V selected by the front panel switch before connecting input supply. The unit will also operate from 310-340V d.c. when set in 230V position.

Warning!

Incorrect selection may result in damage to the unit

Output connections

Output is taken from the large studs on the front panel marked 'OUTPUT' '+' and '-'. Presence of output voltage is indicated by the l.e.d. located near the output terminals, (see note 2 in resistive programming section).

Remote sensing

The remote sensing terminals are situated on the 8-way terminal block on the front panel. As supplied, the sense terminals marked '+S' and '-S' are connected to the terminals marked '+' and '-' by metal links. (The '+' and '-' terminals are connected internally to the main output studs but on no account should load current be drawn from them). For remote sensing applications, both metal links are removed and the +S and -S terminals are connected to the remote load, observing correct polarity. The voltage drop in each output lead should not exceed 5V and the load voltage plus total lead drop should not exceed 6V for 6V nominal units and nominal +5% for other units.

Resistive programming

Output voltage may be programmed by removing the metal link between the 'INT' and 'PROG' terminals and connecting the external programming resistor between the 'PROG' and '+S' terminals. The programming constant is 1kΩ/V ± 0.5% and the unit can be programmed from 1V to the unit maximum voltage.

Notes:-

1) Do not remove the link between the '+S' and '+' terminals unless remote sensing operating is required in addition to resistive programming.

2) The output l.e.d. indicator varies in brightness with change in output voltage and will not be operational for output voltages below approximately 3V.

Remote on/off

Output may be shutdown by a 5V logic 'high' t.t.l. compatible signal applied to + and - shutdown terminals. Drive current 20mA typical. Input isolated from unit output and tested at 1kV a.c. r.m.s.

Mounting and ventilation

The units are provided with M4 threaded fixing holes in the base on both sides.
N.B. FIXING SCREWS MUST NOT BE PROJECT INTERNALLY MORE THAN 6mm WHEN MEASURED FROM OUTER FACE OF POWER SUPPLY. 8mm LONG FIXING SCREWS ARE SUPPLIED.

Cooling is by natural convection and provision should be made to allow free air flow into the bottom and out of the top of the unit, particularly in the area of the main heatsink. If the unit is to be mounted on a flat plate, ventilation holes, corresponding to the unit mesh cover holes and the heatsink plan area, should be punched in the plate, or the unit raised off the plate by at least 25mm.

Units may be operated, if necessary, in an inverted position without derating.

Output hold-up

Output will be maintained for the duration of a missing mains cycle (28ms) at maximum output current and 220V -10% or 115V -10% mains input, when the output is at 6V for 6V nominal units and nominal +5% for other units. See graph on page 5.

Series and parallel operation

Units with the same nominal output voltage may be connected in parallel without limitation.

Units with the same output current rating may be connected in series up to a maximum total output of 250V.

CIRCUIT DESCRIPTION

The mains supply is connected through the input fuse, low pass filter and soft start circuit to bridge rectifier MR601 the d.c. output of which is fed to C601-4.

Linking for 115-120V connects the unit input circuit as a voltage doubler. The primary windings of the main inverter transformer TX402 are switched alternately by VT601 and VT602 across the d.c. line provided at C601-4.

The centre-tapped secondary output of TX402 is rectified by D601 and D604 and applied to the output terminals after filtering by L601, C609, L602 and C610.

Soft start

The charging current for C601-4 at switch-on is limited by resistors R109 and 113 and the unit output is inhibited by VT8 and C14. When the voltage at C14 rises output is established and R190/113 by-passed by relay RL101.

Output voltage control

Overall control is achieved by pulse-width modulation of the inverter transistor 'ON' drive signal by an amount proportional to the error between a sample of output voltage and a reference.

The difference between a sample of output voltage from the potential divider (R503, P501, R25 and P2) and the voltage at Z3 is amplified by the voltage comparator half of IC2 to give a d.c. control signal at the input to the sawtooth generator. This is used to determine the d.c. level of the sawtooth waveform at the generator output (see in-set waveforms on the schematic diagram) which is applied to one input (Pin 2 IC3) of a Schmitt triggered NAND gate. The mark/space ratio of the resulting waveform at the gate output (Pin 3 IC3) is determined by IC3 input trigger level and the level of the applied sawtooth. Thus the d.c. control signal determines the mark/space ratio. The remaining gates of IC3 and IC4 are used to steer controlled mark/space ratio pulses via the drive output stage and drive transformer (TX301) alternately to the switch transistors (VT601 and VT602). When the d.c. control signal is high the mark/space ratio is greatest.

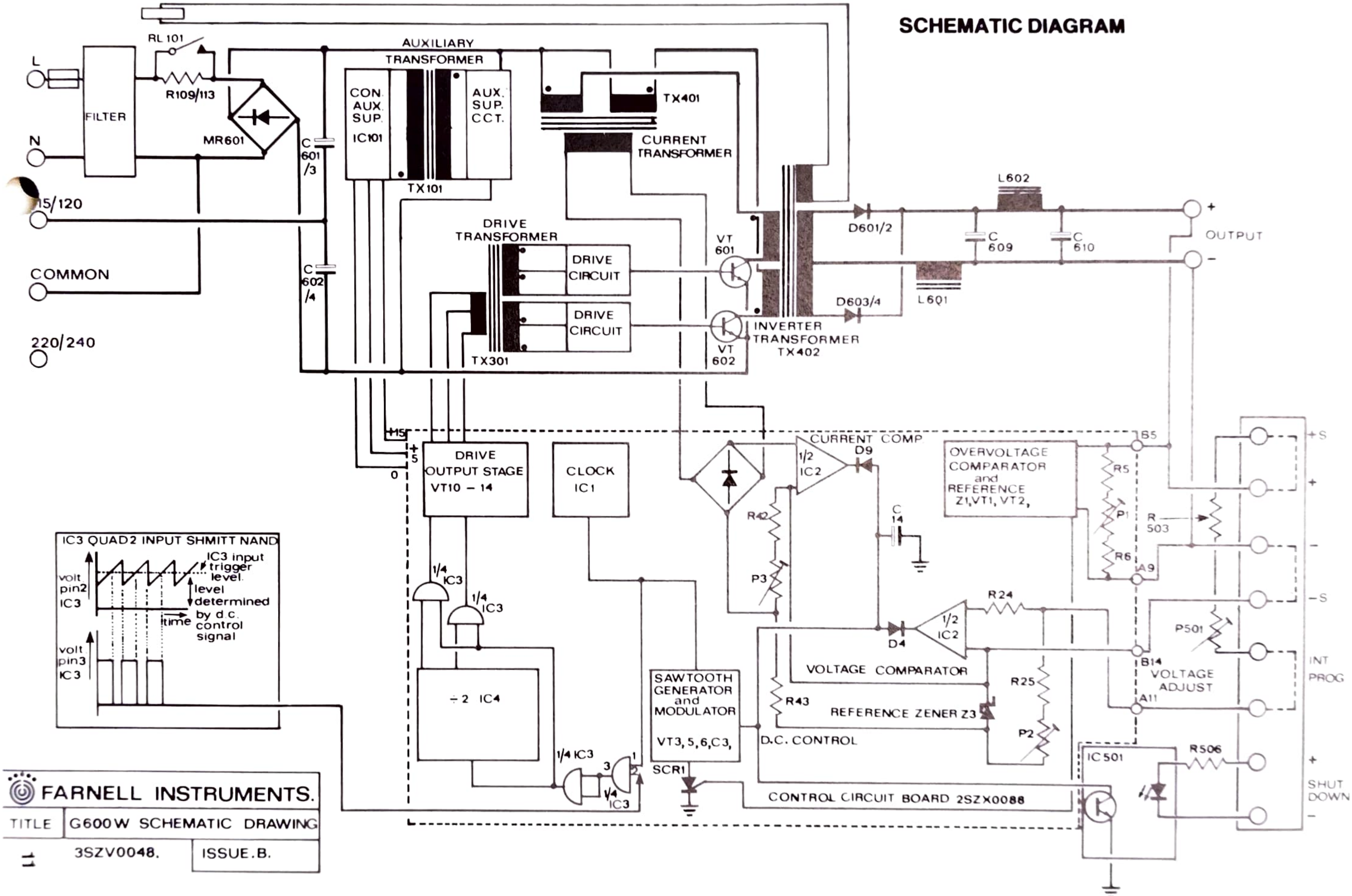
Current control

The switch transistor currents are sampled and instantaneously added by TX401. The composite wave form at TX401 secondary is rectified to provide a signal proportional to the total current drawn from the 350 volt d.c. line. This is compared with a proportion of the reference voltage at Z3. If the current proportional signal exceeds a level set by P3, the output of the current comparator section of IC2 reduces, forward biasing diode D9 and overriding the voltage control signal. The unit output voltage begins to reduce and the voltage comparator output increases, reverse biasing diode D4. Thus control is determined under these conditions by the output of the current comparator. A front panel l.e.d. indicates when current is limiting.

Overvoltage protection

A proportion of output voltage is compared with the voltage across Z1. If the output voltage exceeds the level set by P1, the overvoltage comparator provides a positive gate signal to SCR1. The output of the modulator (and hence unit output) is inhibited as SCR1 conducts. A front panel l.e.d. indicates when the SCR has fired.

SCHEMATIC DIAGRAM



FARNELL INSTRUMENTS.

TITLE	G600W SCHEMATIC DRAWING
3SZV0048.	ISSUE. B.

MAINTENANCE

The equipment supplied by Farnell Instruments Ltd., is guaranteed against defective material and faulty manufacture for a period of twelve months from the date of despatch. In the case of material or components employed in the equipment but not manufactured by us, we allow the customer the period of any guarantee extended to us.

The equipment has been carefully inspected and submitted to comprehensive tests at the factory prior to despatch. If, within the guarantee period, any defect is discovered in the equipment in respect of material or workmanship and reasonably within our control, we undertake to make good the defect at our own expense subject to our standard conditions of sale. In exceptional circumstances and at the discretion of the Service Manager, a charge for labour and carriage costs incurred may be made.

Our responsibility is in all cases limited to the cost of making good the defect in the equipment itself. The guarantee does not extend to third parties, nor does it apply to defects caused by abnormal conditions of working, accident, misuse, neglect or wear and tear.

In the event of difficulty, or apparent circuit malfunction, it is advisable to telephone (or telex) the Service Department or your local Sales Engineer or Agent (if overseas) for advice before attempting repairs.

For repairs it is recommended that the complete unit be returned to:-

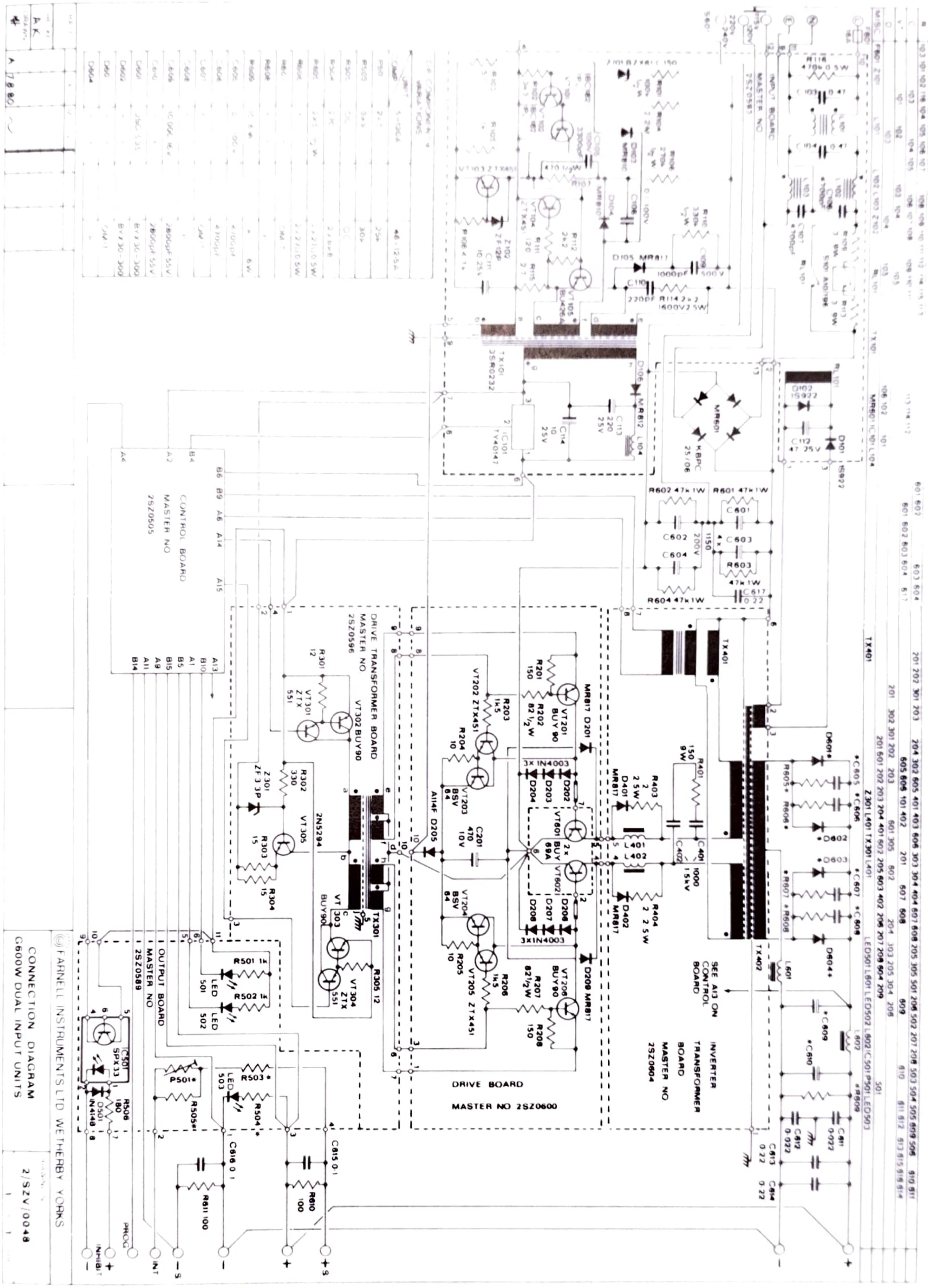
The Service Department,
Farnell Instruments Ltd.,
Sandbeck Way,
Wetherby, Yorkshire.
LS22 4DH.
Tel: 0937 61961 Telex 557294

The Service Department,
Farnell Instruments Ltd., (Regional office south)
Davenport House,
Bowers Way,
Harpenden, Herts. AL5 4HX.
Tel: (05827) 69071 Telex 826307 Farint G

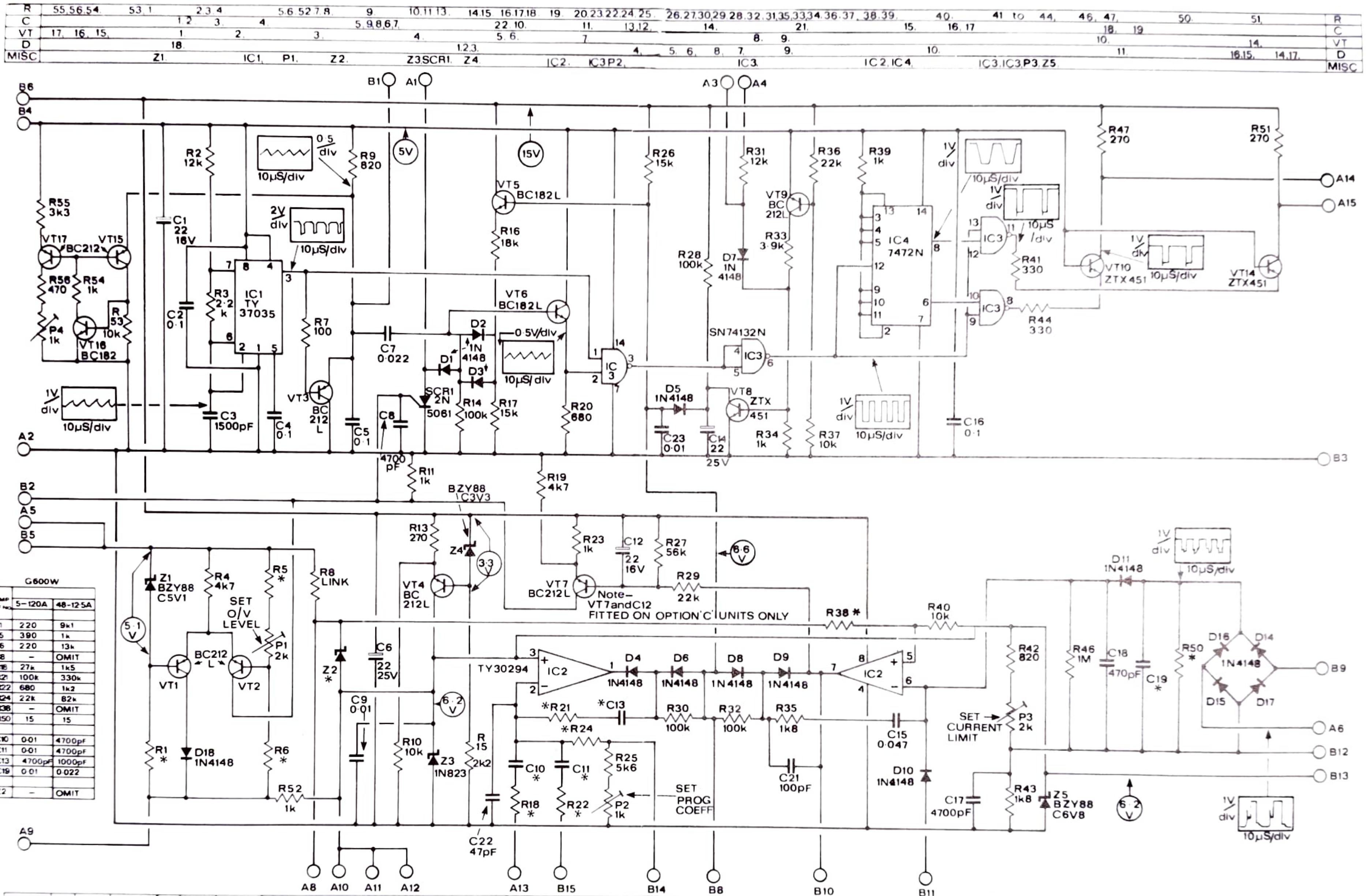
Please ensure adequate care is taken with packing and arrange insurance cover against transit damage or loss.

Warning! - Hazardous voltages (see page 8)

If repairs are to be attempted by the customer these should be undertaken by personnel conversant with this type of equipment.



CONNECTION DIAGRAM
G600W DUAL INPUT UNITS
FARNELL INSTRUMENTS LTD WETHERBY YORKS
2/SZV/0048
INPUT BOARD
MASTER NO 2SZ0583
CONTROL BOARD
MASTER NO 2SZ0505
DRIVE TRANSFORMER BOARD
MASTER NO 2SZ0596
DRIVE BOARD
MASTER NO 2SZ0600
INVERTER TRANSFORMER BOARD
MASTER NO 2SZ0604
OUTPUT BOARD
MASTER NO 2SZ0589
SEE A13 ON CONTROL BOARD



G600W

COMP REF No	5–120A	48–125A
R1	220	9k1
R5	390	1k
R6	220	13k
R8	–	OMIT
R18	27k	1k5
R21	100k	330k
R22	680	1k2
R24	22k	82k
R38	–	OMIT
R50	15	15
C10	0·01	4700pF
C11	0·01	4700pF
C13	4700pF	1000pF
C19	0·01	0·022
Z2	–	OMIT

ISS	DATE	MOD No
A	14.5.80	
B	29.8.80	Q6592

CHECKED: AK
DRAWN: LAN

NOTE – Voltages measured at 240V input, with respect to terminal A2, unless otherwise stated, using a 20,000Ω/Volt meter
Oscilloscope ground connection to A2 terminal

USED ON

*Component values on sheet 2

FARNELL INSTRUMENTS LTD WETHERBY YORKS

CONTROL BOARD DUAL INPUT 'G' 600W CIRCUIT DIAGRAM

2/SZX/0130